Informing nearshore fishery management and monitoring California's MPAs

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Overview

Effective fisheries management requires fishery-independent data. Similar data are also needed to evaluate the recently established Channel Islands Marine Reserves (Channel Islands Marine Protected Areas Monitoring Plan, 2004). Together, the needs are broad in biological and geographical scope. Fish and invertebrate populations in shallow, rocky habitats throughout California are accessible to divers. This has led to collaborative efforts between the California Department of Fish and Game (CDFG), various universities, private organizations, and government programs to gather and report data for fishery management and performance of marine protected areas. The resulting collaboration is known as the Cooperative Research and Assessment of Nearshore Ecosystems (CRANE) effort.

Cabezon (*Scorpaenichthys marmoratus*) are sought in the commercial live fish fishery.

Data Needs

Management of two shallow water fisheries (Nearshore Fishery Management Plan, 2002; Abalone Recovery and Management Plan, 2005), will benefit from fishery-independent inputs provided by CRANE. Whether the goal is fishery management or MPA assessment, information on the following parameters is required:

- Abundance
- Mortality
- Age and growth
- Recruitment
- Ecological interactions
- Reproductive characteristics
- Distribution of stocks
- Movement patterns

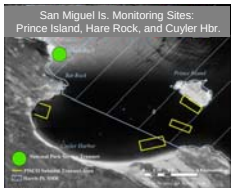


Figure 1. For MPA assessment and long-term management at the Channel Islands, sites within and outside the protected area must be monitored.

Current monitoring efforts emphasize visual surveys of fish and invertebrate populations in shallow subtidal (scuba), and deep subtidal (ROV) rocky reef and kelp habitats. Scuba surveys measure abundance, size, and species composition of fish and invertebrates. Habitat characteristics (relief and percent cover) are also recorded. Data on number and size of fishes provide an estimate of abundance and, over time, estimates of growth, recruitment, and mortality. We will use data on fish populations and benthic communities to evaluate ecological interactions. This information may also be used as an input for stock assessment models.

For assessing MPA performance, the same data are needed. Results within and among protected sites will be compared to nearby unprotected sites (Fig. 1). Since it will take a number of years for populations to respond, monitoring over time is required to help managers determine the impacts and effectiveness of the MPA network at the Channel Islands.

Survey Protocol

CRANE collaborators developed a common field protocol for surveying invertebrates and fishes. Survey protocols were modeled on established rocky reef study design and survey techniques of the University of California, Santa Cruz and U.C. Santa Barbara affiliates of the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO).

Fish surveys

Divers enumerated fishes along randomized 30 x 2 x 2 m transects (Fig. 2), along the bottom and mid-water. Twenty-four replicate transects were surveyed at each level per site. Transects were allocated spatially, and among three to four depth zones 5-20 m deep. Fish length was estimated to the nearest cm for fish up to 15 cm; estimates for larger fish were made to the nearest 5 cm. A graduated measuring device on the data slate was used to calibrate size estimates.

Figure 2. Benthic fish survey. Divers measure and record fishes along forty-eight 30 m transects at each site.

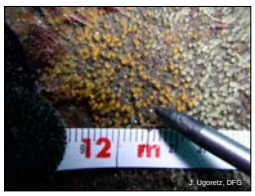


Figure 3. Percent cover of benthos is measured using Uniform Point Contact. Here, a solitary tunicate species is recorded. Substrate relief is also measured at each point along the 30 m transect.

Invertebrate and algae surveys

Divers recorded macroalgae and invertebrate abundance along twelve 30 x 2 m transects at each site. Data on percent cover were taken along the same transects using a point contact method (Fig. 3). In addition, size frequency of abalone and urchins was gathered.

MPA monitoring at the Channel Islands

The variety of biological parameters and habitats assessed at the Channel Islands MPAs requires a greater suite of research tools. Current MPA monitoring efforts include:

Fishing Studies -	Trap and hook-and-line gears target species not adequately surveyed by scuba surveys; allows comparisons to scuba estimates of the same areas
Recruit. Studies -	Density and abundance of young-of-the-year fishes
Aerial Surveys -	Density and area covered for giant kelp (*Macrocystis*); document fishing locations
ROV Surveys -	Abundance, size and species composition of fish in deep water habitats

Survey Implementation

In 2004, supported by funds from the Coastal Impact Assistance Program, 88 sites were surveyed by collaborating groups (Fig. 4). During that summer's field season, over 1,700 dives were made along 800 km of coastline from Santa Cruz to San Diego. At the northern Channel Islands, surveys were conducted in cooperation with the MPA monitoring effort at locations established during the MPA siting process. This represents an unprecedented cooperative effort to survey subtidal resources in California, and provides the most comprehensive snapshot of subtidal fish and invertebrate populations to date.

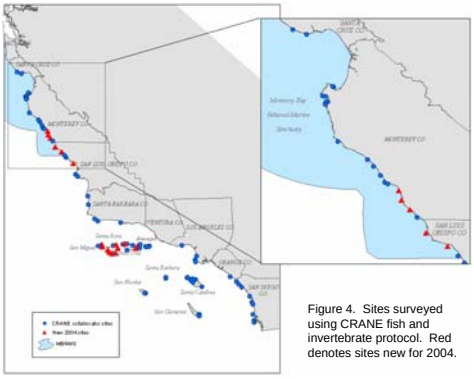


Figure 4. Sites surveyed using CRANE fish and invertebrate protocol. Red denotes sites new for 2004.

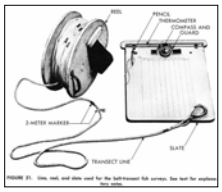
(Note: Wide-scale CRANE surveys received one-time funding for 2004. Subsequently, not all sites have been surveyed annually. Continued data gathering efforts of this magnitude currently lack long-term funding.)

Historical Data

In addition, collaborators provided data from historical fish and invertebrate surveys conducted along the coast (Table 1). Data at some sites were collected in the 1970s. The historical data may allow us to evaluate changes in the abundance of species over time. Careful interpretation is needed before trends are determined; sample units, seasons, sites, and survey design used by different programs must be reconciled.

Table 1. CRANE scuba survey collaborators

Institution	Principal Investigator	Data
UCSB	J. Caselle	2004; historical 1999 - 2004
UCSB	D. Schroeder	2004; historical 1995 – 2000
UCSC	M. Carr	2004; historical 1999 – 2003
National Parks	D. Kushner	Historical 1980 – 2004
Occidental	D. Pondella	2004; historical 1974 – 2004
Scripps	E. Parnell	Historical 1983 – 2004
SDSU	T. Anderson, M. Edwards	2004
Tenera	J. Carroll	2004; historical 1978 - 2003



Gear for visual fish surveys, ca. 1959. Basic swath methodology remains unchanged. (Figure from Wheeler and Hubbs, 1968. Utilization of Kelp-Bed Resources in Southern California.)

Results

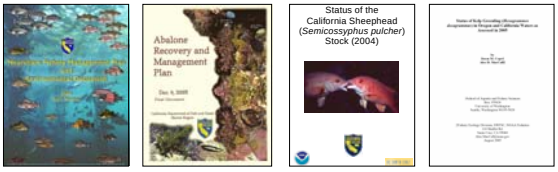
Results of the survey are available online. The report contains information on abundance and size structure of populations of nearshore fish and invertebrates, including a perspective on how populations have changed over time.

- How fish and invertebrate abundance and size varies among survey areas
- How variations are related to habitat quality, or location
- How fish and invertebrate abundance and size has changed over time

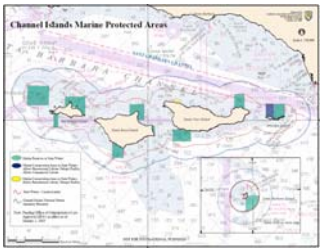
Please visit www.dfg.ca.gov/mrd/fir to download a copy of the report and for information on available data.

Applications

Data gathered by this survey may be used to refine and inform fisheries management. For example, data may be used for stock assessments (e.g., California sheephead and kelp greenling). In addition, evaluation of the Channel Island MPAs will rely on a subset of the data collected by the CRANE effort.



Data gathered by the CRANE effort will inform management via stock assessments. Recent nearshore stock assessments include CA sheephead, and kelp greenling.



CRANE monitoring will help quantify the efficacy of the reserve network at the Channel Islands. Due to the size and scope of the project, field work at all the protected areas is only possible through cooperation and partnerships.

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